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# Psychometric evaluation of a novel measure of posttraumatic safety behaviors

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# Psychometric evaluation of a novel measure of posttraumatic safety behaviors

**by**

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# Abstract

## Psychometric evaluation of a novel measure of posttraumatic safety behaviors

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Safety behaviors are unnecessary protective actions taken to prevent, escape, or reduce the severity of a perceived threat. Previous research has demonstrated that the use of safety behaviors contributes to appraisal of relevant stimuli as threatening. According to several prevalent theories, threat appraisals following a traumatic event contribute to a sense of ongoing threat that maintains posttraumatic stress disorder (PTSD). Despite the conceptual link between safety behaviors and PTSD, little research has been done to investigate this relationship. This thesis aims to bridge that gap by providing a novel self-report measure of posttraumatic safety behaviors, the Posttraumatic Safety Behavior Inventory (PSBI), and psychometrically evaluating this scale in a sample of trauma survivors found on Amazon Mechanical Turk. Our findings suggest that the PSBI is best characterized by a single-factor model and displays favorable internal consistency, test-retest reliability, convergent validity, and discriminant validity. Our findings also suggest that scores on the PSBI are highly significantly associated with trauma-related threat appraisals and PTSD status, and can be used to distinguish between trauma survivors with

and without PTSD. Our work suggests that safety behaviors are relevant to PTSD despite the lack of research on this topic. Researchers and clinicians working with people suffering from PTSD are encouraged to incorporate the PSBI into their work in order to better understand the role of safety behaviors in PTSD.

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# Introduction

Posttraumatic stress disorder (PTSD) is defined in the Diagnostic and Statistical Manual of Mental Disorders, 5th Edition (DSM-5) as a reaction to exposure to a traumatic event that includes re-experiencing the event, avoiding trauma-related stimuli, increased negative thoughts or feelings, and increased arousal and reactivity (American Psychiatric Association [APA], 2013). Approximately one half of adults in the United States will experience a traumatic event during their lifetime (National Institute of Mental Health, 2017), and Breslau (2009) reports that approximately one in ten people exposed to a traumatic event will develop PTSD. Research has implicated several dysfunctional reactions to trauma, specifically safety behaviors and threat appraisal, as significant contributors to the development and maintenance of the disorder.

## SAFETY BEHAVIORS

Safety behaviors are common responses to many types of fear or threat. Most people engage in behaviors that contribute to their feeling of safety on a regular basis, such as wearing a seatbelt while driving or avoiding stepping in front of moving traffic. Much of the time, these behaviors are adaptive and useful, as they are connected to a real danger. These actions become problematic, however, when they are used in an effort to keep the person using them from experiencing anxiety, rather than in response to a realistic threat (Salkovskis, 1991; Helbig-Lang & Petermann, 2010). These types of behaviors, called safety behaviors, are defined by Telch and Lancaster (2012) as

"unnecessary actions taken to prevent, escape from, or reduce the severity of a perceived threat" (p. 315).

Because a given safety behavior is used to prevent, escape from, or reduce the severity of a specific threat, common profiles of safety behavior usage are often seen in anxiety disorder. For example, excessive and unnecessary cleaning is often used to reduce the perceived threat of germs in obsessive-compulsive disorder, while reassurance-seeking may be used to reduce the perceived threat of uncertainty in generalized anxiety disorder. Safety behaviors in PTSD are unique in that they are most often related to the memory of a traumatic event (Telch & Zaizar, in press) rather than a current threat. People struggling with PTSD may avoid situations that remind them of the traumatic event, even if those situations are objectively safet, and may also avoid thinking about memories of the trauma. Other mental maneuvers such as thought suppression or distracting oneself from trauma-relevant thoughts are also common. For example, a woman who experienced a sexual assault may avoid the location in which she was assaulted, and a veteran may avoid or suppress memories of combat. Thus, safety behaviors are specific not only to different threats, but also to the people who engage in them.

## EVIDENCE SUGGESTING THAT SAFETY BEHAVIORS MAY INCREASE RELEVANT THREAT APPRAISALS AND ANXIETY

The role of safety behaviors in the development of anxiety has been increasingly studied in recent years. Consistently, research has shown that engaging in safety behaviors contributes to higher rates of anxiety. For example, Deacon and Maack (2008)

demonstrated the potency of safety behaviors in the development of contamination fear in a within-subjects study. In their study, college students with high and low levels of contamination fear were assigned to engage in contamination-related safety behaviors, such as applying hand sanitizer or avoiding touching potentially contaminated objects, at every opportunity, for one week. Immediately after one week of completing these safety behaviors, participants with both high and low levels of baseline contamination fear reported significantly higher contamination fear than at baseline. This fear persisted in both groups even after participants were instructed to return to their usual activities for one week. This study clearly demonstrates that safety behaviors have a powerful role in the development of anxiety, even after the use of the safety behaviors has returned to baseline levels.

Safety behaviors have also been shown to increase one's appraisal of a stimulus as threatening. In another study, Olatunji, Etzel, Tomarken, Ciesielski, and Deacon (2011) employed a similar design, with the addition of a control group, to investigate the effects of safety behaviors on threat appraisal and health anxiety. Participants were assigned to either engage daily in a variety of health-related safety behaviors or to a control group in which they monitored their normal safety behavior use. After just one week, participants who were assigned to engage in safety behaviors reported significantly greater increases in health anxiety, beliefs related to hypochondriasis, and behavioral avoidance of health-related risks compared to the monitoring-only control group. After returning to normal activities for one week, participants who had engaged in safety behaviors continued to report higher rates of these beliefs and avoidance than the control

group. The experimental manipulation in this study provides further evidence that engaging in, but not simply monitoring, safety behaviors contributes to the development of related threat appraisal and anxiety.

More recently, van Uijen and Toffolo (2015) assessed the effect of engaging in checking safety behaviors on development of OCD symptoms. Participants were assigned for one week to engage in daily checking behaviors representative of OCD, to monitor their normal checking behavior, or to a control group. After one week, only the group that engaged in daily checking displayed increased checking-related cognitions, including the importance of checking, the likelihood of threat, and the severity of threat. This overall increase in checking-related cognitions was mediated by an increase in cognitions about the severity of the threat. General symptoms of anxiety, however, did not increase. These findings provide further support for the role of safety behaviors in the development of relevant threat appraisal and threat-specific anxiety.

Several theories have been proposed to explain the anxiogenic effects of safety behaviors. Researchers have suggested that safety behaviors may interfere with one's ability to disconfirm situations as threatening by misattributing one's safety to the presence of a safety behavior rather than the lack of actual threat (Salkovskis, 1991), or by undermining one's ability to cope with a threatening situation in the absence of a safety behavior (Sloan & Telch, 2002). Telch and colleagues (Sloan & Telch, 2002; Telch & Lancaster, 2012) have also suggested that performing safety behaviors requires an individual to allocate attention to the safety behavior, leaving fewer cognitive and attentional resources for threat processing and disconfirmation. Sloan and Telch (2002)

have also suggested that safety behaviors may transmit neural threat signals even in the absence of cognitive threat appraisal. In a related theory, Deacon and Maack (2008) theorized that safety behaviors may contribute to the development of anxiety because engaging in safety behaviors inherently increases selective attention to the perceived threat. In order to engage in a safety behavior, a person must first attend to the perceived threat that necessitates that safety behavior, which increases awareness of the threat. In addition to this theory, Olatunji et al. (2011) proposed that the simple suggestion that a person should engage in safety behaviors may increase the perception of threat, which then increases the frequency of threat-related cognitions and anxiety, and may contribute to catastrophization of the threat. By engaging in safety behaviors or merely thinking that one should engage in safety behaviors, threat appraisal of stimuli targeted by the safety behaviors is perpetuated.

### THREAT APPRAISAL MODELS OF PTSD

Threat appraisals have been implicated in many prominent models of PTSD. For example, Foa and Kozak (1986) proposed emotional processing theory, in which a person's threatening beliefs, or appraisals, about a situation interact with their emotional reactions to develop a sense of fear. Later, Foa and Rothbaum (1998) applied this theory to PTSD, suggesting that the specific maladaptive beliefs that, "the world is completely dangerous," and, "the self is totally incompetent," contribute to the sense of ongoing fear experienced in PTSD, and are therefore important in both development and maintenance of the disorder. Foa, Ehlers, Clark, Tolin, and Orsillo (1999) later found that appraisals

related to threats after a trauma typically fall into three categories of thoughts: negative thoughts about the world, negative thoughts about the self, or self-blame, which together cultivate a sense of current threat and maintain PTSD, even long after the traumatic event has occurred.

In another influential theory of the development of PTSD, Ehlers and Clark (2000) proposed a cognitive model, in which the processing of the traumatic event produces a sense of ongoing threat. In this model, individual differences in processing the meaning and consequences of the traumatic event are a core component in the development of PTSD. These appraisals are specific to each individual and trauma, and may include thoughts such as, "nowhere is safe," or, "I deserve that bad things happen to me." These threat appraisals interact with memory disturbances and maladaptive coping strategies to contribute to a sense of ongoing threat that is characteristic of PTSD (Ehlers & Clark, 2000).

In order to identify cognitive factors involved in the development of PTSD, Dunmore, Clark, and Ehlers (1999) compared cognitive factors of physical and sexual assault survivors who developed PTSD to those who did not. Participants were recruited approximately 20 months after experiencing an assault. Participants were assessed for PTSD symptoms and cognitive factors that occurred in the month after the assault as well as at the time of assessment. The researchers found that participants who met criteria for PTSD in the month after the assault reported significantly more negative appraisals of both assault-related emotions and symptoms during or shortly after the assault than did participants who did not develop PTSD. The researchers theorized that, in accordance

with Ehlers and Steil (1995), these negative appraisals are related to a sense of ongoing threat, which manifests itself in PTSD. In developing an appraisal of a traumatic event and its consequences, a patient can either learn to see the threat as temporary, or can develop an ongoing sense of current threat and other negative emotions, leading eventually to PTSD.

Although safety behaviors have been shown to contribute to the development of threat appraisals, and threat appraisals are important in the development of PTSD, there has been a lack of research investigating safety behaviors used in PTSD. This is particularly surprising given that avoidance, one of the most commonly used safety behaviors across disorders, is a diagnostic criterion of PTSD (APA, 2013). Because of the putative importance of safety behaviors in PTSD, together with the lack of research on this topic, we have developed and psychometrically evaluated a novel instrument for assessing the use of safety behaviors after experiencing a traumatic event, the Posttraumatic Safety Behaviors Inventory (PSBI). We believe that the development and distribution of this scale will allow for research to be conducted on this important but overlooked topic.

## SPECIFIC AIMS AND HYPOTHESES

### Specific Aim 1

The first specific aim of this study was to develop a psychometrically sound instrument for assessing safety behaviors used after a traumatic event – the Posttraumatic Safety Behaviors Inventory (PSBI). We hypothesized that, after careful development of

the items, the PSBI would display favorable psychometric characteristics including internal reliability, test-retest reliability, factor validity, and convergent/discriminant validity.

**Specific Aim 2**

The second specific aim of this study was to investigate the relationship between scores on the PSBI and trauma-related threat appraisals in trauma survivors with and without a diagnosis of PTSD. We hypothesized that scores on the PSBI would be positively associated with trauma-related threat appraisals.

**Specific Aim 3**

The third specific aim of this study was to investigate the utility of PSBI in distinguishing between trauma survivors with and without a diagnosis of PTSD. We hypothesized that scores on the PSBI could be used to distinguish between trauma survivors with and without a PTSD diagnosis.

# Methods

## Scale Development

Items on the PSBI were carefully developed by members of the Laboratory for the Study of Anxiety Disorders at The University of Texas at Austin. Items were developed to represent the full range of safety behaviors commonly used by people with PTSD. The scale instructs participants to indicate how often they perform the indicated safety behavior in order to cope with the traumatic event they experienced. Participants who reported experiencing multiple traumatic events were instructed to refer to the traumatic event that currently haunts them the most when completing the scale. The PSBI is included as an appendix.

## Procedure

Participants were recruited through Amazon Mechanical Turk and were asked to complete questionnaires and computer tasks about their physical and mental health. After providing informed consent, participants completed a series of questionnaires. Four of these questionnaires, including the PSBI, were novel questionnaires developed by members of the Telch Lab. The rest of the measures had been previously validated. Male participants also completed a dot-probe task measuring reaction time to words related to erectile functioning. The computer task and each of the validated questionnaires were included for the purposes of psychometric evaluation of one of the four novel measures; therefore, the computer task and some measures are not relevant to the PSBI but are reported nonetheless.

In order to reduce invalid responding, approximately ten false items were included throughout the questionnaires to check that participants were paying attention. These attention check items were designed to appear similar to the real items, but instructed the participant to select a certain response to indicate they were paying attention (e.g., "Physical avoidance of reminders of your experience please ignore the previous statement and select usually"). In the case that a participant did not correctly complete any one of the attention check items, their survey terminated prematurely, they did not receive compensation for their participation, and their data were excluded from the final dataset.

## PARTICIPANTS

Participants were recruited online through Amazon Mechanical Turk. Participants were paid $0.50 for completing the survey, a typical payment for a study of this length. A small sample of participants (N=14) was recruited to complete the survey a second time, one to two weeks later, to assess test-retest reliability. This small sample of participants was paid $1.50 per participant for the second survey completion. In total, 2196 participants attempted to complete the study, and 1884 of these participants were excluded from analyses. Participants were excluded from analyses for the following reasons: (1) did not consent to participate; (2) responded incorrectly to attention check items; (3) indicated suicidal ideation on more than half the days of the last two weeks, as indicated by item nine of the Patient Health Questionnaire-9; (4) had duplicate IP addresses, which may indicate duplicate or fraudulent responding (Robinson, 2016); (5)

provided a trauma description that clearly indicated invalid or fraudulent responding; (6) did not report having experienced a criterion A traumatic event as defined by the DSM-5 (APA, 2013); or (7) did not complete the PSBI (see Table 1). Participants who indicated frequent suicidal ideation were provided with the National Suicide Prevention Lifeline phone number and were encouraged to call. In total, 312 participants were included in the following analyses.

| | N |
|---|---|
| Total attempted to participate | 2196 |
| Total excluded | 1884 |
| Did not consent to participate | 4 |
| Responded incorrectly to attention check items | 1255 |
| Suicidal ideation, as indicated by a score of 2 or higher on PHQ-9 | 380 |
| Duplicate IP addresses | 5 |
| Invalid trauma description | 20 |
| No criterion A trauma | 181 |
| Did not complete PSBI | 39 |
| Total included | 312 |

Table 1: Reasons for exclusion

## MEASURES

### Demographics

Basic demographic information was collected, including age, sex, race, sexual orientation, relationship status, employment status, state and country of residence, education level, income, medical problems, tobacco use, alcohol use, psychiatric medication use, and psychotherapy use.

**Validated Assessment Measures**

*PSTD Symptom Checklist for DSM-5* (PCL-5; Weathers et al., 2013b). The PCL-5 is a twenty-item self-report scale that assesses symptoms of PTSD. The severity of each of the DSM-5 diagnostic criteria (e.g., "Repeated, disturbing, and unwanted memories of the stressful experience") over the past month is assessed using a Likert scale from 0 (Not at all) to 4 (Extremely). The assessment has demonstrated strong internal consistency, test-retest reliability, and convergent and discriminant validity (Blevins, Weathers, Davis, Witte, & Domino, 2015), and can be used to screen for PTSD. Item and cluster scores on the PCL-5 were used to determine provisional PTSD diagnosis in accordance with Weathers et al. (2013b). Provisional PTSD diagnosis is reported as PTSD status throughout this paper.

*Anxiety Sensitivity Index–3* (ASI-3, Taylor et al., 2007). The ASI-3 is an eighteen-item self-report measure of anxiety sensitivity that includes three subscales of concerns, including physical (e.g., "It scares me when my heart beats rapidly"), cognitive (e.g., "When I cannot keep my mind on a task, I worry that I might be going crazy"), and social (e.g., "When I tremble in the presence of others, I fear what people might think of me"). Each item is rated on a Likert scale from 0 (Very little) to 4 (Very much). The ASI-3 has been shown to have high internal consistency, convergent validity, discriminant validity, and criterion-related validity (Taylor et al., 2007).

*Patient Health Questionnaire-9* (PHQ-9; Kroenke, Spitzer, & Williams, 2001). The PHQ-9 is a widely-used nine-item self-report measure of depression. The PHQ-9 assesses the frequency of each of the nine DSM-5 (APA, 2013) diagnostic criteria for

major depressive disorder (e.g., “Feeling down, depressed, or hopeless”) over the prior two weeks using a Likert scale from 0 (Not at all) to 3 (Nearly every day). The scale is designed to measure both diagnosis and severity of depression. The total score is taken by summing the scores of the items. The PHQ-9 has demonstrated good validity as well as high sensitivity and specificity (Kroenke et al., 2001).

*Posttraumatic Cognitions Inventory-9* (PTCI-9; Wells et al., 2017). The PTCI-9 is a nine-item self-report scale that assesses negative posttraumatic cognitions. The PTCI-9 is an abridged version of the Posttraumatic Cognitions Inventory (Foa, et al., 1999). The PTCI-9 assesses three domains of negative posttraumatic appraisals: negative thoughts about the self (e.g., “Nothing good can happen to me anymore”), negative thoughts about the world (e.g., “People can’t be trusted”), and self-blame (e.g., “The event happened because of the way I acted”) using three items to calculate a score for each type of cognition. Participants rate each item on a Likert scale from 1 (Totally disagree) to 7 (Totally agree). The three subscale scores are calculated by taking the mean of the three items in each domain, and the total score is calculated by taking the mean of the three subscale means. The PTCI-9 has demonstrated good internal consistency and convergent validity (Wells et al., 2017).

*Health Anxiety Questionnaire* (HAQ; Lucock & Morley, 1996). The HAQ is a twenty-one-item self-report scale that assesses anxiety about health and somatic symptoms. Participants rate the frequency of their health anxiety (e.g., “Do you ever feel afraid that you may have cancer?”, “Do your bodily symptoms stop you from enjoying yourself?”) on a scale from 0 (Not at all or rarely) to 3 (Most of the time). The total score

for the HAQ is calculated by summing the scores for all items. The HAQ has demonstrated good internal consistency, test-retest reliability, and convergent/discriminant validity (Lucock & Morley, 1996).

*Life Events Checklist for DSM-5 – modified* (LEC-5; Weathers et al., 2013a). The LEC-5 is a twenty-six-item self-report scale that assesses lifetime potentially traumatic events. The LEC-5 assesses level of exposure to sixteen common traumatic events (e.g., "Physical assault (for example, being attacked, hit, slapped, kicked, beaten up)") and provides an opportunity for participants to add an additional traumatic event not listed. The LEC-5 has demonstrated good convergent validity (Weathers et al., 2013a). A modified version of the LEC-5 was used to determine if participants had directly experienced each of the listed traumatic events one or more times. In order to maximize the chance that our survey captured experiences that are classified as a Criterion A trauma in the DSM-5 (APA, 2013), the modified version did not include options to indicate that participants had witnessed the event, learned about it, or been exposed as part of their job, and instead asked only about events that the participants had directly experienced. Additionally, only the sixteen traumatic event items, but not the follow-up items, were used.

*Social Behavior Questionnaire* (SBQ; Clark et al., 1995). The SBQ is a twenty-seven-item self-report scale that measures the frequency of use of safety behaviors in social settings. Participants rate how often they use safety behaviors (e.g., "Rehearse sentences in your mind," "Avoid eye contact") when they are anxious during or before a social situation using a Likert scale from 0 (Never) to 3 (Always). The total score for the

SBQ is calculated by summing the scores of all of the items. The SBQ has demonstrated good internal consistency, test-retest reliability, and convergent/discriminant (Plasencia, 2008).

*Appraisal of Social Concerns Scale* (ASC; Telch et al., 2004). The ASC is a twenty-item self-report scale that measures social anxiety-related cognitions. Participants rate how concerned they would feel about a variety of outcomes in social situations (e.g., "People laughing at you," "Trembling") on a scale from 0 (Not at all concerned) to 100 (Extremely concerned), with ten-point intervals. The total score on the ASC is calculated by taking the mean of all item scores. The ASC has demonstrated good validity and internal consistency (Schultz et al., 2006).

*International Index of Erectile Functioning – abridged version* (IIEF-5; Rosen, Cappelleri, Smith, Lipsky, & Peña, 1999). The IIEF-5 is a five-item self-report measure of erectile function and intercourse satisfaction that is used to identify the presence of erectile dysfunction. The IIEF-5 assesses erectile functioning using a Likert scale from 1 (Very low; Almost never/never; or Extremely difficult) to 5 (Very high, Almost always/always; or Not difficult). The total score on the IIEF-5 is the sum of the five items. The IIEF-5 has demonstrated good specificity and sensitivity in identifying erectile dysfunction (Rosen et al., 1999; Rosen, Cappelleri, & Gendrano, 2002), as well as good reliability and validity (Rosen et al., 2002).

*Erectile Performance Anxiety Index* (EPAI, Telch & Pujols, 2013). The EPAI is a ten-item self-report scale that assesses anxiety about erectile performance. The scale measures anticipatory anxiety of sexual performance, anxiety during sexual activity, and

safety behaviors related to erectile functioning. Participants rate each item on a Likert scale from 1 (Not like me) to 5 (Very much like me). The total score is calculated by summing the scores on all ten items. The EPAI has demonstrated excellent internal consistency as well as good convergent and discriminant validity (Telch & Pujols, 2013).

**Novel Assessment Measures**

All novel assessment measures were included for the purpose of psychometric evaluation of the measure.

*Texas Multifactor Anxiety Sensitivity Scale* (TMASS; Telch & Zaizar, unpublished). The TMASS is a fifteen-item self-report scale that assesses five a priori conceptually-based profiles of anxiety concerns: (a) cardiac concerns (e.g., "My anxiety may ultimately lead to a heart attack"), (b) respiratory concerns (e.g., "My anxiety will cause me to have trouble breathing"), (c) social concerns (e.g., "My anxiety will lead me to embarrass myself in front of others"), (d) loss of control concerns (e.g., "Anxiety may cause me to lose control of my actions"); and (e) incapacitation concerns (e.g., "Anxiety may cause me to lose my capacity to take care of myself). Participants rate each item on a scale from 0 (Not at all) to 4 (Very much). The total score on the TMASS is calculated by summing the scores for all items.

*Texas Health Anxiety Inventory* (THAI; Telch, unpublished). The THAI is a forty-four-item self-report scale that assesses one's level of health anxiety over the past week. The THAI assesses (a) frequency and severity of anxiety about health problems, (b) frequency of use safety behaviors used to cope with health anxiety, (c) confidence about

resisting the urge to perform health anxiety-related safety behaviors, and (d) severity of physical and emotional symptoms. The total score on the THAI is calculated by summing the scores for all items.

*Posttraumatic Safety Behaviors Inventory* (PSBI; Foulser & Telch, unpublished). The PSBI is a thirteen-item self-report scale for assessing level of trauma-relevant safety behaviors. The scale assesses frequency of use of ten trauma-relevant safety behaviors (e.g., "Avoiding certain people, activities, or situations that remind you of the trauma") on a scale from 0 (Never) to 4 (Always), and provides space for participants to add up to three safety behaviors not listed. The total score on the PSBI is calculated by summing the scores for all items. The scale is modeled after the Texas Safety Maneuvers Scale (TSMS; Kamphuis & Telch, 1998), which has been reported to have high internal consistency, convergent validity, discriminant validity (Kamphuis & Telch, 1998), and construct validity (Helbig-Lang, et al., 2014). *Note: All analyses in this paper include only items 1 through 10 of the PSBI (i.e., not the write-in items).*

**Dot-Probe Attention Bias Task**

Male participants completed a dot-probe attention bias task following the questionnaires. In this task, participants were briefly presented with two words, one on each side of the computer screen. One of the words was a penile/erection-related word (e.g., aroused), whereas the other word was a neutral word (e.g., credit). Participants were then asked to respond to a probe cue that appeared on either the left or right side of the

screen. This task took approximately 5 minutes to complete. This task was included to correspond with the EPAI and its results are not reported here.

# Results

## DEMOGRAPHICS

312 Amazon Mechanical Turk Workers participated in this research study. The mean age for the sample was 38.33 (*SD*=12.12). Approximately 60% of the sample was female, and approximately 74% of the sample was white/Caucasian. Detailed demographics information is provided in Table 2.

| | |
|---|---|
| Age – M *(SD)* | 38.33 *(12.12)* |
| Sex – N *(%)* | |
| Male | 123 *(39.4%)* |
| Female | 188 *(60.3%)* |
| Intersex | 1 *(0.3%)* |
| Race – N *(%)* | |
| White/Caucasian | 232 *(74.4%)* |
| African American | 24 *(7.7%)* |
| Asian | 29 *(9.3%)* |
| Other or Multiple Races | 27 *(8.7%)* |
| PTSD Status [1] – N *(%)* | |
| With PTSD | 86 *(27.6%)* |
| Without PTSD | 226 *(85.3%)* |

Table 1: Demographics

[1] PTSD status is determined by provisional PTSD diagnosis using scores on the PCL-5 as detailed in Weathers et al. (2013b)

## DESCRIPTIVE STATISTICS

The overall mean score on the PSBI was 12.91 (*SD*=8.82). Scores on the PSBI were positively skewed, with kurtosis of -.385 and skewness of 0.360. Male and female trauma survivors displayed similar scores on the PSBI ($t(265.6)=-0.273$, $p=0.785$), with males scoring on average 12.78 (*SD*=8.68) and females scoring on average 13.06 (*SD*=8.90).

## EXPLORATORY FACTOR ANALYSIS

An exploratory factor analysis with an oblique promax rotation was conducted to examine the structure of the PSBI's ten items. The three write-in items were not included in the factor analysis as a brief review of these items suggested that many of the responses would be captured by one of the main ten items. A scree plot of eigenvalues

| | One-factor model | Two-factor model |
|---|---|---|
| Items with no salient loadings on any factor[2] | 0 | 1 |
| Factors well-defined[3] | 1 | 2 |
| Variance explained | 46% | 53% |
| Number of items per factor | 10 | 4, 5 |
| Factor 1 and 2 intercorrelation | - | 0.74 |
| Factor 1 coefficient alpha | 0.89 | 0.85 |
| Factor 2 coefficient alpha | - | 0.81 |

Table 2: Summary of one- and two-factor solutions

[2] Salient loading = at least 0.4.
[3] Well-defined factor = at least 3 items. No items loaded onto more than one factor.

was suggested that a one-factor solution was most appropriate. Both one-factor and two-factor models were considered and are summarized in Table 3. The two-factor model explained 53% of the variance, which was slightly better than 46% explained in the one-factor model. However, when using a factor loading threshold of 0.4, the two-factor solution dropped one item ("Checking, rehashing, or analyzing the traumatic event in your mind"), which we found important to retain. Therefore, a one-factor model was determined to be the best fit for the PSBI. This is not unexpected given that safety behaviors used to cope after a traumatic event is already a relatively specific construct. Item loadings onto the single factor are listed in Table 4.

| Item | Factor loading |
|---|---|
| 1 | 0.81 |
| 2 | 0.71 |
| 3 | 0.72 |
| 4 | 0.71 |
| 5 | 0.68 |
| 6 | 0.66 |
| 7 | 0.57 |
| 8 | 0.63 |
| 9 | 0.57 |
| 10 | 0.69 |

Table 3: Factor loadings using a one-factor model

### INTERNAL CONSISTENCY OF THE PSBI

Internal consistency of items on the PSBI was examined using an item-total correlation. The item-total correlations are displayed in Table 5 and ranged from .814

(item 1; excellent) to .627 (item 9; fair). All but three items (items 7, 8, and 9) fell within a good or acceptable range (e.g., above 0.7). Items 7 (reassurance seeking), 8 (using safety aids), and 9 (using drugs and alcohol) fell between 0.6 and 0.7. Although the item-total correlation for these three items is slightly lower than we would prefer, we feel that these posttraumatic safety behaviors are conceptually important to include in the PSBI, and therefore we retain them.

| Item | Item-total correlation |
|---|---|
| 1 | .814 |
| 2 | .722 |
| 3 | .747 |
| 4 | .749 |
| 5 | .720 |
| 6 | .703 |
| 7 | .630 |
| 8 | .683 |
| 9 | .627 |
| 10 | .738 |

Table 4: Item-total correlation of the PSBI

**CONSTRUCT VALIDITY OF THE PSBI**

Pearson's *r* correlations of the PSBI total score with the other validated measures included in the self-report battery are shown in Table 6. The PSBI displays good convergent validity, as it is highly significantly correlated with symptoms of PTSD (Pearson's $r$=.840, $p$=<.000) and posttraumatic threat appraisals (Pearson's $r$=.597, $p$<.000). The PSBI also displays good discriminant validity, as it is not significantly

correlated with any of the other measures. The one exception, erectile functioning, is negatively correlated with the PSBI, suggesting that people with better erectile functioning have fewer posttraumatic safety behaviors. This is not surprising, given that this describes a mentally and physically healthy profile.

| Measure | PSBI | PCL-5 | PTCI-9 | ASC | PHQ-9 | ASI-3 | HAQ | SBQ | IIEF-5 |
|---|---|---|---|---|---|---|---|---|---|
| PSBI | 1.00 | | | | | | | | |
| PCL-5 | .840 | 1.00 | - | - | - | - | - | - | - |
| PTCI-9 | .597 | .649 | 1.00 | - | - | - | - | - | - |
| ASC | .067 | .035 | -.004 | 1.00 | - | - | - | - | - |
| PHQ-9 | .006 | -.008 | -.003 | .598 | 1.00 | - | - | - | - |
| ASI-3 | -.011 | -.037 | -.090 | .640 | .556 | 1.00 | - | - | - |
| HAQ | -.021 | -.026 | -.066 | .493 | .526 | .735 | 1.00 | - | - |
| SBQ | -.036 | -.065 | -.103 | .620 | .488 | .643 | .485 | 1.00 | - |
| IIEF-5 | -.247 | -.223 | -.223 | -.100 | -.039 | .035 | .039 | -.088 | 1.00 |

Table 5: Pearson's *r* correlations among the PSBI and all validated measures[4]

**TEST-RETEST RELIABILITY**

Fourteen participants completed the PSBI a second time to assess test-retest reliability. The mean interval of time between completions was 10.1 days. The Pearson correlation between scores on the PSBI on these two assessment dates was $r$=.86, which indicates good test-retest reliability.

[4] Note: PCL-5 = PTSD Symptom Checklist for DSM-5; PCTI-9 = Posttraumatic Cognitions Inventory-9; ASC = Appraisal of Social Concerns scale; PHQ-9 = Patient Health Questionnaire-9; ASI-3 = ; HAQ = Health Anxiety Questionnaire; SBQ = Social Behaviour Questionnaire. Life Events Checklist for DSM-5 was omitted because participants indicated if they had experienced the event once or more than once but not a specific number of times, thus a total score is not informative.

### PSBI SCORE IN TRAUMA SURVIVORS WITH AND WITHOUT PTSD

A Welch's two-sample t-test found that trauma survivors with PTSD (N=86) scored significantly higher on the PSBI than did trauma survivors without PTSD (N=226; t(180.66)=16.834, p<.000). As shown in Figure 1, trauma survivors with PTSD had an average score of 22.37 (SD=5.81) on the PSBI, while trauma survivors without PTSD had an average score of 9.31 (SD=6.89) on the PSBI.

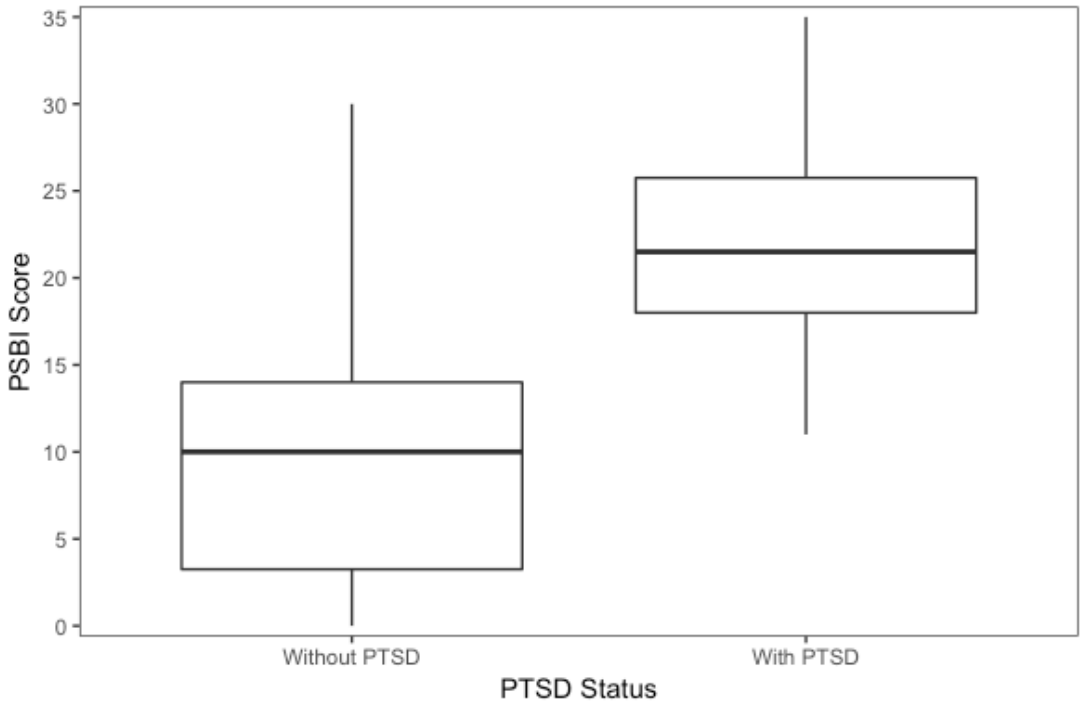


Figure 1: PSBI score in trauma survivors with and without PTSD

### SAFETY BEHAVIORS AND THREAT APPRAISAL IN TRAUMA SURVIVORS WITH AND WITHOUT PTSD

Because it has been established that threat appraisal is associated with the use of safety behaviors (Telch & Lancaster, 2012; Salkovskis, Clark, & Geder, 1996) and also that the use of safety behaviors is associated with increased threat appraisal (Deacon &

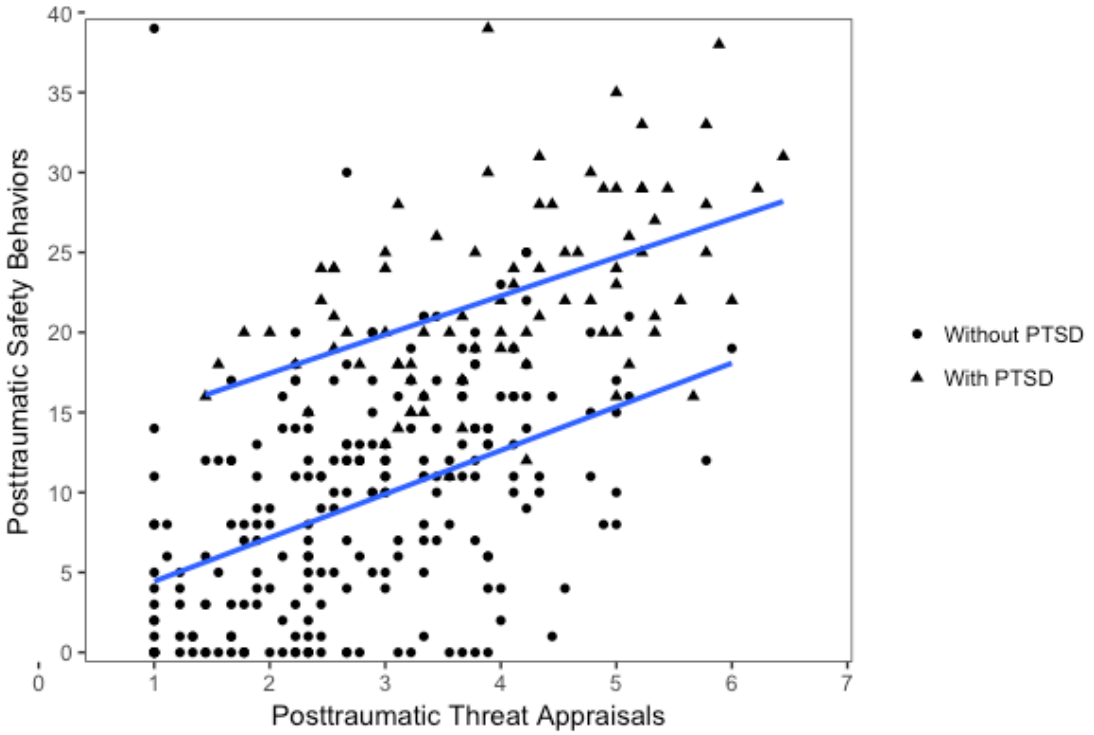


Figure 2: Trauma-related threat appraisals and PTSD status, but not their interaction, are significantly positively associated with posttraumatic safety behaviors

Maack, 2008; Olatunji et al., 2011; van Uijen & Toffolo, 2015), we ran a linear regression in order to investigate this relationship in trauma survivors. Two outliers with Bonferonni p-values for studentized residuals <.05 were dropped. The effect of the interaction of trauma-related threat appraisals and PTSD status on posttraumatic safety behaviors was not significant ($p$=0.369), suggesting that the relationship between threat appraisals and safety behaviors was not significantly different between trauma survivors with and without PTSD. After removing the interaction, we found that trauma-related safety behaviors and PTSD status were both significantly positively associated with posttraumatic safety behaviors (see Figure 2). Participants' predicted total score on the

PSBI was equal to 1.260, and each one-point increase on the PTCI-9 was associated with an increase of 2.802 points on the PSBI ($p$<.000), and a diagnosis of PTSD based on the PCL-5 was associated with an increase of 9.796 points on the PSBI ($p$<.000). This model including both PTCI-9 score and PTSD status was the best fit (F(2,307)=234.2, p<.000; AIC=1938.276). According to a Breusch-Pagan test for heteroskedasticity, however, the residuals of the PSBI in this model violated the homogeneity of variance assumption ($p$=.034), and this model may therefore be uninterpretable.

### SENSITIVITY OF PSBI IN DISTINGUISHING BETWEEN TRAUMA SURVIVORS WITH AND WITHOUT PTSD

In order to determine the utility of the PSBI in distinguishing between trauma survivors with and without PTSD, we ran a logistic regression including all factors that might putatively distinguish PTSD status, including age, sex, and scores on the PSBI, PTCI-9, PHQ-9, and ASI-3. One intersex person was dropped from these analyses. Of these factors, only sex and PSBI score were significantly associated with PTSD status, suggesting that being male increased one's odds of having PTSD by 146% ($p$=.016), and a one unit increase on the PSBI increased one's odds of having PTSD by 38% ($p$<.000).

The first three items on the PSBI ask about avoidance safety behaviors. As has been previously noted, avoidance is one of the symptom clusters required for diagnosing PTSD (APA, 2013). While we believe it is important to understand avoidance as a safety behavior as well as a symptom of PTSD, we also recognize that this overlap in symptoms may impact the statistical relationship between PTSD status and scores on the PSBI. In order to ensure that this relationship was not driven solely by overlapping symptoms, we

ran the same logistic regression omitting the three PSBI avoidance items. After removing the avoidance items, sex (i.e., being male), PSBI score, and also PTCI-9 score were significantly positively associated with having PTSD. Specifically, after removing the avoidance items on the PSBI, being male increased one's odds of having PTSD by 130% ($p$=.022), a one-unit increase on the PTCI-9 increased one's odds of having PTSD by 48% ($p$=.024), and a one-unit increase on the PSBI increased one's odds of having PTSD by 43% ($p$<.000). These consistently high odds ratios suggest that the PSBI avoidance items were not accounting for the entire relationship between PSBI score and PTSD status, and, rather, after omitting the PSBI avoidance items, the ability of the PSBI to distinguish PTSD status actually improved. The odds ratios for both models are displayed in Figure 3.

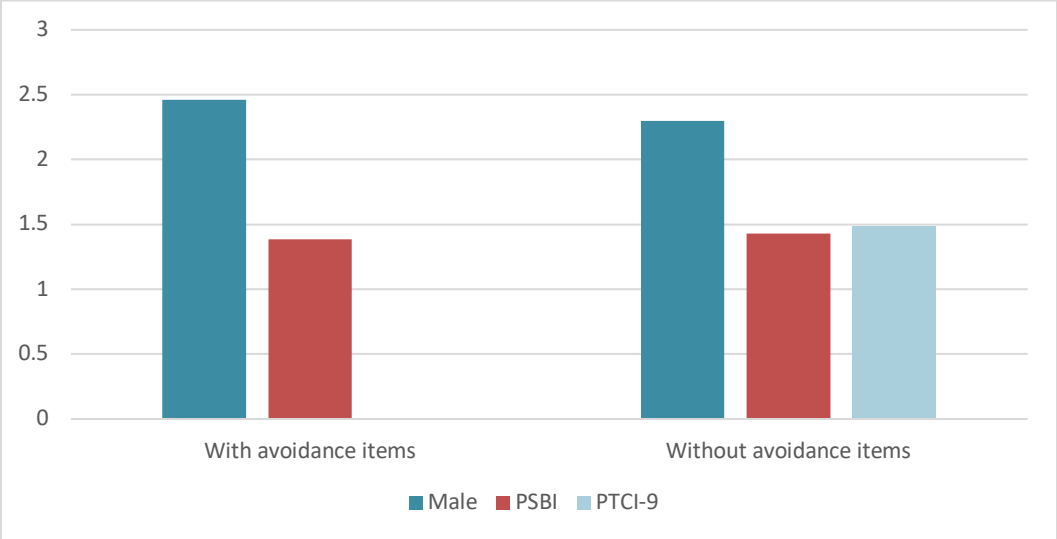


Figure 3: Scores on the PSBI, along with sex and scores on the PTCI-9, can be used to distinguish PTSD status

# Discussion

## Conclusions

This study aimed to develop a psychometrically sound self-report measure of safety behaviors used after a traumatic event, the PSBI. The PSBI is a thirteen-item self-report instrument that assesses ten specific classes of safety behaviors that may be used after a traumatic event, and allows for three write-in items for patients to describe specific safety behaviors not listed.

Our analyses suggest that the PSBI has good internal consistency and test-retest reliability. Our analyses also suggest that the PSBI displays high convergent validity, as scores on the PSBI are highly and significantly correlated with scores on other measures related to PTSD such as symptoms of PTSD, as well as good discriminant validity, as scores on the PSBI are not correlated with safety behaviors used in other domains, such as to cope with social anxiety, or with other unrelated constructs such as health anxiety. A factor analysis also revealed that the PSBI is best characterized by a single-factor model, which is unsurprising given that posttraumatic safety behaviors constitute a fairly specific construct.

Scores on the PSBI did not differ between male and female trauma survivors. Trauma survivors who met criteria for PTSD based on the PCL-5 reported using posttraumatic safety behaviors significantly more than did trauma survivors who did not meet criteria for PTSD.

Because previous research (Deacon & Maack, 2008; Olatunji et al., 2011; van Uijen & Toffolo, 2015) has established that using safety behaviors increases relevant

threat appraisal and anxiety, and threat appraisal leads to increased use of safety behaviors (Telch & Lancaster, 2012), we investigated the relationship between posttraumatic safety behaviors and posttraumatic threat appraisals in trauma survivors. Using a linear regression, we found that posttraumatic safety behaviors were significantly positively associated with both trauma-related threat appraisal and PTSD status, and that the relationship between safety behaviors and threat appraisals was similar in trauma survivors with and without PTSD. Because our study was cross-sectional, we are unable to determine causality and directionality of our results. However, based on previous experimental research (Salkovskis et al., 1996; Deacon & Maack, 2008; Olatunji et al., 2011; van Uijen & Toffolo, 2015), we expect that this relationship between threat appraisals and safety behaviors is bidirectional; that is, the use of safety behaviors following a trauma contributes to an increase in trauma-related threat appraisals, but also that increased appraisal of situations as threatening may lead an increased use of safety behaviors in order to cope with the perceived threat.

In addition to being significantly associated with cognitive aspects of PTSD, the PSBI also demonstrated utility in distinguishing between trauma survivors with and without PTSD. Higher scores on the PSBI, over and above any other metric except for sex (i.e., being male), conferred the greatest increased risk for a diagnosis of PTSD. In order to ensure that this relationship was not driven solely by overlapping factors (i.e., avoidance), we ran the analyses a second time excluding the PSBI avoidance items (items 1, 2, and 3). After removing the avoidance items, sex (i.e., being male), higher posttraumatic threat appraisals, and higher posttraumatic safety behavior usage all

conferred increased risk for a PTSD diagnosis. Importantly, the odds of having PTSD based on the PSBI were higher when using the seven non-avoidance items than using all ten items, including avoidance items, suggesting that the relationship between PSBI score and PTSD status exists even when excluding the overlapping construct of avoidance. This strong statistical relationship between posttraumatic safety behaviors and PTSD status supports our belief that safety behaviors are an important and relevant facet of PTSD, despite the lack of research on this topic.

Overall, our research suggests that safety behaviors are an important component of PTSD. Until now, there has been a lack of research linking these two constructs. We hope that our construction of the PSBI will allow further research as well as better-informed clinical practice to be conducted in this field.

## LIMITATIONS

Our research study has several important limitations. This study was conducted on Amazon Mechanical Turk. We excluded over 50% of data due to participants failing to pay close attention to our survey or other possible fraudulent responding. Although we used rigorous screening methods to screen out invalid respondents, it is possible, though unlikely that our data still contain invalid respondents. This screening process highlights the overall low data quality on Amazon Mechanical Turk, and we implore other researchers using Amazon Mechanical Turk samples to take care to screen out invalid respondents. Additionally, Mechanical Turk respondents may not be representative of a

typical community sample, and it is therefore possible that our findings are not widely generalizable.

Additionally, as mentioned previously, this data is cross-sectional in nature rather than experimental. Therefore, we cannot determine causality based on this work alone. Instead, taken in the context of other research, we can make only suppositions about the probable meaning of our findings.

## FUTURE DIRECTIONS

We have several suggestions for future research and clinical work to be done using this novel instrument. First, it may be useful to develop versions of the PSBI specific to different trauma types. For example, a woman who was raped on a first date might avoid going on first dates, while a man who was in a car accident might avoid driving on particular streets. While both of these safety behaviors fall under the category of situational avoidance (i.e., item 1 of the PSBI), these behaviors are quite distinct. Therefore, it may be useful to develop trauma-specific versions of the PSBI that include specific safety behaviors commonly used by people who have experienced a specific type of trauma, rather than a general PSBI with classes of safety behaviors. We believe our measure is an important first step in developing these trauma-specific instruments.

In addition to future research, mental health professionals working with patients suffering from PTSD or patients who have experienced a traumatic event should incorporate the PSBI into their clinical work. Cognitive-behavioral therapy in particular often focuses on identifying and modifying behaviors as a means to relieving emotional

distress. The PSBI is well-suited to identify behaviors that can be targeted during treatment. Based on the success of clinical trials that employ the strategy of fading safety behaviors in other anxiety disorders (Telch & Lancaster, 2012), it is likely that using the PSBI to identify treatment targets, and then fading these safety behaviors through psychotherapy, will result in an improved prognosis for PTSD patients. Additionally, based on the utility of the PSBI in distinguishing between trauma survivors with and without PTSD, the PSBI could be used as a screening tool in both research and clinical settings.

## SUMMARY

In summary, the PSBI is a novel, single-factor, and psychometrically sound self-report measure of posttraumatic safety behaviors. The distribution of this measure will allow future research to be done in the important field of posttraumatic safety behaviors, and will allow clinicians to identify treatment targets in order to better serve their patients suffering from PTSD.

# Appendix

## Posttraumatic Safety Behaviors Inventory

**INSTRUCTIONS:** Listed below are protective actions that people sometimes perform to **cope** with traumatic events. Read each item carefully and then click the button which best describes how often you perform each action to cope with the traumatic event you experienced.

**Scale**: 0 = Never; 1 = Rarely; 2 = Sometimes; 3 = Usually; 4 = Always

1. **Avoiding certain people, activities, or situations that remind you of the trauma** (for example, avoiding people who look like your assaulter, avoiding the place where the trauma occurred).
2. **Avoiding memories of the trauma** (for example, intentionally pushing away or distracting yourself from memories of the trauma).
3. **Avoiding negative emotions associated with the trauma** (for example, attempting to push away or not allow yourself to feel sadness, anger, shame, or fear).
4. **Physical checking for potential threats or safety associated with the trauma** (for example, exits, types of people, trucks, hospitals).

5. **Checking, rehashing, or analyzing the traumatic event in your mind** (for example, intentionally reviewing aspects of the trauma, thinking about what you could or should have said or done).
6. **Reassuring yourself related to the trauma** (for example, reminding yourself everything is okay or telling yourself not to worry).
7. **Seeking reassurance from others to cope with the trauma or your reactions to it** (for example, asking for reassurance from friends, partner, other family members, boss, or others).
8. **Using or having safety aids available to help you cope with the trauma or your reactions to it** (for example, carrying pepper spray, keeping a knife in your car, bringing a companion with you, keeping the TV or radio on).
9. **Using alcohol or drugs to cope with memories or negative feelings connected to the trauma** (for example, having to drink or take a tranquilizer in situations that remind you of the trauma).
10. **Changing the way you do things as a result of the trauma or your reactions to it** (for example, driving your car at a slower speed, walking more quickly down the street, changing the way you dress, or having to sit in a restaurant facing the door).
11. Other: _____
12. Other: _____
13. Other: _____

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